## CLAIMS

WHAT IS CLAIMED IS:

1. A pyrometer for use in measuring temperatures in a furnace, comprising:

support means for supporting an optical head in a port of the furnace for viewing an interior of the furnace along a line-of-sight, the optical head converting infrared radiation into electrical signals;

a photometer circuit connected to the optical head for processing the electrical signals;

a scaling circuit connected to the photometer circuit for scaling the electrical signals;

an output circuit connected to the scaling circuit for receiving scaled electrical signals and producing output signals;

output means connected to the output circuit for use to display the output signals or to supply information corresponding to the output signals or to use the output signals as control signals for the furnace;

power supply connected to the scaling circuit for powering the photometer, the scaling and the output circuits; and

calibration means in the scaling circuit for calibrating the scaling of the electrical signals to be most sensitive to a wavelength of middle infrared radiation to which at least one gas component in the furnace is semi-transparent, for measuring the temperature of the at least one gas component.

2. A pyrometer according to claim 1, wherein the support means comprises a lens-tube

having one end extending into the port of the furnace and an opposite end, an enclosure connected to the opposite end of the lens-tube, and at least one circuit board in the enclosure for supporting the scaling circuit, the output circuit and the power supply.

3. A pyrometer according to claim 2, including a circuit board in the lens-tube for supporting the photometer circuit.

4. A pyrometer according to claim 3 including a heat shield around the lens-tube and at an entry location the lens-tube into the furnace port.

5. A pyrometer according to claim 1 including gas cooling means connected to the support means for cooling the optical head.

6. A pyrometer according to claim 2 including gas cooling means connected to the enclosure for cooling the enclosure.

7. A pyrometer according to claim 6 wherein the lens-tube comprises inner and outer tubes with a gas space therebetween, the cooling means including means for supplying cooling gas to the space between the inner and outer tubes for cooling the optical head.

8. A pyrometer according to claim 7 including a cap with an aperture connected to the end of the lens-tube in the furnace port for directing the cooling gas as it leaves the lens-tube to purge the lens-tube.

9. A pyrometer according to claim 1 wherein the means for calibrating the scaling circuit comprise means for scaling the electrical signals to be most sensitive to infrared radiation between about 1.3 and 3.1 microns.

10. A pyrometer according to claim 9 wherein the means for calibrating the scaling circuit

scales the electrical signals to be most sensitive to infrared radiation at about 1.38 microns for measuring the temperature of $H_2O$.

11. A pyrometer according to claim 9 wherein the calibration means scales the electrical signals to be most sensitive to wavelengths between 1.8 and 2.0 microns.

12. A pyrometer according to claim 9 wherein the calibration means scales the electrical signals to be most sensitive to wavelengths between 3.3 and 3.1 microns.

13. A pyrometer according to claim 1 wherein the optical head includes a lens for focusing infrared radiation from the furnace, an IR bandpass filter for passing the focused infrared radiation between about 1.3 and 3.1 microns wavelength, and a photodetector for receiving the focused and filtered radiation.

14. A pyrometer according to claim 13 wherein the photodetector comprises a germanium photodiode.

15. A pyrometer according to claim 1 wherein the optical head includes a lens for focusing infrared radiation from a line-of-sight cone of a solid angle of about 3 to 8 degrees from the furnace, an IR bandpass filter for passing the focused infrared radiation, and a photodetector for receiving the focused and filtered radiation.

16. A method of measuring temperature in a furnace comprising:

positioning a pyrometer having an optical head in a port of the furnace, with a line of sight intersecting a passage of gas in the furnace containing a plurality of gas components;

receiving infrared radiation from the gas as it passes the line of sight;

converting the infrared radiation in the optical head to electrical signals; and

scaling the optical signals to maximize signals generated by infrared radiation which is semi-transparent to the gas components.

17. A method according to claim 16 including scaling the electrical signals for infrared radiation in a wavelength range of about 1.3 to about 3.1 microns.

18. A method according to claim 17 including scaling the signals for infrared wavelengths of about 1.38 microns for sensing the temperature of $H_2O$ as the gas component trade.

19. A method according to claim 16 including scaling the electrical signals for wavelengths between 1.8 and 3.1 for measuring the temperature of mixtures of $H_2O$, $CO_2$ or mixtures thereof.